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Response efficiency: Behavioural manifestations of an emotion-led subjective experience of duration

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Abstract

Numerous theories have been proposed on the influence of emotion on our perception of time, with recent work favouring attentional mechanisms as opposed to more traditional accounts of an ‘internal clock’ (Lui, Penney, & Schirmer, 2011). For example, the perceived duration of an emotional event may depend on both its behavioural relevance, as well as the stimulus-driven salience of its features (Lambrechts et al., 2011; Bradley & Lang, 2007; Noulhiane et al., 2007; Gil et al., 2007). In the same light, seminal work by Eagleman (2008) focused on subjective duration perception following short and automatic (as opposed to lengthier and more cognitively loaded) events. The literature however, lacks an account of observable differences in response efficiency (i.e., response time and accuracy), which may be related to changes in our perception of an emotional event’s duration, specifically in relation to automatic emotionally loaded events. Drawing from behavioural findings from three studies investigating effects of facial emotion on response efficiency (which however do not explicitly measure subjective timing), this theoretical presentation attempts to recast our results from the above perspective of the proposed relation between attentional engagement and subjective duration.

Our three experiments were originally designed to investigate rapid spatial attentional engagement to emotional stimuli. We measured the effects of the poser’s eye-gaze, concurrent auditory threat, and participant’s rated anxiety on the speed and accuracy of responses to facial emotion in three speeded forced-choice studies. In Study 1, 24 right-handed healthy adults viewed bilateral displays of a neutral face paired with either a fearful or angry face, and presented for 50ms; the task was to indicate the left-right location of the emotional face. Stimuli varied in intensity of facial expression, and gaze (left, right, ahead). Study 2 (N=23, all right-handed) increased stimulus exposure time to 100ms with added looming or receding sound unpredictably per trial, to test whether looming sounds selectively enhance emotional face detection. In Study 3 (N=24, all right-handed),

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participants viewed brief bilateral displays of angry or happy faces paired with their respective neutral expression, and also completed the State Anxiety sub-scale (Y-1) of the Spielberger State-Trait Anxiety Inventory.

Gaze did not lead to a detection advantage for angry faces in Tasks 1 & 2 regardless of stimulus exposure time or auditory threat unpredictability. Interestingly though, response efficiency was increased for both anger and fear, and further increased with the addition of looming sounds. Effects were found even for extremely subtle and ambiguous emotional expressions. In Task 3, we observed a speed-accuracy trade off in highly anxious participants particularly for ambiguous faces with emotional intensities near to threshold.

By observing the modulation of response efficiency in displays of automatic and ambiguous emotional faces, we propose that these findings and previous results could be explained in terms of attentionally-driven changes in duration perception. Attention appears to modulate response efficiency depending on the emotional salience of a stimulus, with more of our attentional resources being needed when faced with an ambiguous emotional event. Even when considering responses from highly anxious participants, it appears as though it is not the specific nature of the event itself that shapes their responses, but the ambiguity of the stimuli they are presented with. It could therefore be the case that our subjective experience of duration of an emotional event is inherently linked with the level of reflex-like automaticity that the event itself presents. When our attention is ‘grabbed’ by a sudden exposure to an emotional stimulus, our consequently speeded and more efficient response might reflect a dilation of subjective time during response preparation – perhaps especially important when the event is pertaining to threat. Though the present data do not pertain directly to subjective timing, it is possible that the attentional demands posed on participants while deciphering the relevance of ambiguous emotional stimuli could have caused changes in duration perception of the kind previously reported to be associated with emotional stimuli. Our theoretical suggestion could therefore lead to future studies combining reaction times and accuracy with an explicit measure of duration perception.

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Keywords: Timing; Duration perception; Emotion; Threat; Response efficiency

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